附件 2　浙江水利水电学院“南浔青年学者”申请表

<table>
<tr><td>姓　名</td><td>张三霞</td><td>出生年月年龄
（年龄）</td><td>1988 年 7 月岁
（ 34 岁）</td><td>参加工作时间</td><td>2019 年 7 月</td></tr>
<tr><td>现所在单位
（部门）</td><td>机械与汽车工程学院</td><td>最高学历/学位</td><td>博士研究生</td><td>专业技术职务</td><td>讲师</td></tr>
<tr><td>符合条款</td><td colspan="5">符合科研类，发表 3 类论文两篇，绩点 100</td></tr>
<tr><td rowspan="6">所涉业绩</td><td rowspan="2">教学类
绩点：_____</td><td colspan="4"></td></tr>
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<tr><td rowspan="2">科研类
绩点：100</td><td colspan="4">SCI 论文 2 篇（50*2）</td></tr>
<tr><td colspan="4"></td></tr>
<tr><td rowspan="2">人才称号类
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<tr><td colspan="4"></td></tr>
<tr><td>总绩点</td><td colspan="4">100</td></tr>
<tr><td colspan="5">备注：请严格按照《浙江水利水电学院“南浔青年学者”实施办法（试行）》（浙水院〔2022〕114 号）附件《业绩成果绩点赋值项目库》的类目、分类、等级（等次）、绩点填写。</td></tr>
<tr><td>个人承诺</td><td colspan="5">本人承诺上述所填内容真实、准确；如有不实，本人承担相应责任。
签名：张三霞 时间：2022.11.24</td></tr>
<tr><td colspan="6">以上部分由申请人填写，所在单位审核。以下由单位（部门）和学校填写。</td></tr>
<tr><td>所在单位
（部门）意见</td><td colspan="5">1.经审核，申请人所填内容：□属实　□不属实；
2.是否符合所申请的类别：□符合　□不符合；
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<tr><td>科技处
审核意见</td><td colspan="2">负责人签名：　（部门盖章）
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Influences of operating parameters on the aerodynamics and aeroacoustics of a horizontal-axis wind turbine

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ABSTRACT

A computational framework used to evaluate the aerodynamics and aeroacoustics is developed and validated against the experimental data in the previous work. In the present work, the different operating parameters of inlet flow velocity, tip speed ratio and turbulence intensity have been considered separately. The aerodynamic performance, the vortex dynamics and the aerodynamic acoustics of the full scale horizontal-axis wind turbine under different operating conditions have been investigated. And the analysis of the impact of different operating parameters is discussed. It is observed that the model has an extension to different conditions and it is sensitive and accurate for simulating the results of different condition parameters. According to the results, the wind with lower turbulence intensity will be better for the operating, and the wind turbine operation can be optimized by adjusting the rotating speed (TSR) according to the inflow wind velocity. In the end, a noise and power trade-off graphics has been proposed based on the wind turbine acoustics and performance results. With enough operating conditions available for reference, selecting the optimal operating parameters under specific operating conditions according to the noise and power trade-offs graphics becomes feasible.

1. Introduction

Energy is a vital input for social and economic development in any country including China. With the agricultural and industrial activities in the country increasing, the demand for energy is also increasing. On the other hand, it is observed that there are growing concerns about global energy demand and environmental pollution [1]. In a positive and responsible attitude, China is actively fulfilling its obligations under the international environmental conventions. For many important international environmental conventions, China has formulated a proactive and actionable plan of action. According to the "13th Five-Year Energy Development Plan" in China [2], the proportion of non-fossil energy consumption will be increased to more than 15% during the plan from 2016 to 2020. In that regard, wind energy will play a significant role in the near future [3]. Wind energy has been developing rapidly in China, and the cumulative installed capacity of wind power in China exceeded 168 GW in 2016 according to the statistics [2]. China plans to speed up the development of wind power in the eastern and southern regions, where there is a need to improve low-speed wind turbine technology and micro-site selection level to promote decentralized wind power construction.

With the growing interest in decentralized wind power construction, small-scale wind turbines are an interesting option for household and small firms. To make such an investment more efficient, it is crucial for the wind turbine working conditions to be favorable. Therefore there is a need to research the operating characteristics under variable operating conditions and optimize the operating parameters of the wind turbine [4]. And the establishment of a cost-effective model to study the influence of parameters is needed. In addition, the noise is another vital problem that should be considered [5]. Since the sites are often located near rural areas, conflicts with the recreational life of people nearby often occur [6]. Noise is an annoyance factor at wind farms and hence there is a need for reliable methods to solve problem [7]. It is time consuming and difficult to conduct field measurement that contain a large variety of metrological problems [8]. Therefore it is

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Influences of operating parameters on the aerodynamics and aeroacoustics of a horizontal-axis wind turbine

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关键词

作者关键词: Large-eddy simulation; Aerodynamics; Aeroacoustics; Operating parameters; Horizontal-axis wind turbine

KeyWords Plus: LARGE-EDDY SIMULATION; TURBULENT INFLOWS; PRESSURE MEASUREMENT; WAKE CHARACTERISTICS; AIRFOIL PERFORMANCE; POWER PERFORMANCE; FIELD EXPERIMENTS; NOISE PREDICTION; OPTIMIZATION; FLOW

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Large-eddy simulation and wind-tunnel measurement of aerodynamics and aeroacoustics of a horizontal-axis wind turbine

Kun Luo [a, b, *], Sanxia Zhang [b], Zhiying Gao [a, c], Jianwen Wang [a, c], Liru Zhang [a, c], Renyu Yuan [b], Jianren Fan [b], Kefa Cen [b]

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ABSTRACT

Large-eddy simulation of the whole three-dimensional vortex dynamics and noise radiation around a horizontal-axis wind turbine has been studied and analyzed together with wind-tunnel experimental measurement. A computational framework that takes into account of the true shape of the wind turbine blade geometry for calculating the aerodynamics and aeroacoustics is developed and validated against the experimental data. The LES results generally agree well with the experimental data in terms of both the aerodynamics and aeroacoustics statistics. The formation and development of the complex three-dimensional wake vortexes are captured and analyzed, and the aerodynamic noise is further studied based on the flow field using the FW–H method. It is found that noise generation and acoustic radiation are closely associated with the generation and evolution of these vortex structures. The blade tip region is the main resource area of the aero-noise and the acoustic radiation intensity of the rotor decreases rapidly downstream.

1. Introduction

The aerodynamic research and wake flow analysis for wind turbines have contributed a lot to the success of modern wind energy utilization [1–3], and technologies for wind energy conversion have significantly advanced during the past few decades. The Horizontal-Axis Wind Turbine (HAWT) is the least expensive and clean way to make use of the wind power. As the interaction between the wind and the blade influences the efficiency, the design and development of more efficient and reliable wind turbines rely heavily on accurate prediction of aerodynamic behaviors and can benefit significantly from a good knowledge of parameters related to the wake [4,5]. However, some environmental and social problems still remain unsolved, and the wind turbine noise becomes the most serious issue among them [6]. The wind turbine noise, especially the aerodynamic noise is even hindering the global use of the wind turbine. It is thus very important to understand the noise source mechanisms, depending on the rotor aerodynamic characteristics and the operating conditions for a wide range of the rotor's frequency spectrum [7,8].

Methods of different levels of complexity to investigate the aerodynamic and aeroacoustic behaviors of a wind turbine rotor have been developed. These methods include the Blade Element Momentum (BEM) theory, the wind tunnel experiment, the field experiment and the computational fluid dynamics (CFD) [1]. The BEM theory that proposed by Glauert is the most classical approach for the aerodynamic design of wind turbine [9]. However, it requires adding a number of amendments to the project [10]. The BEM theory occupies fewer resources in the calculation and it would be relatively more rapid, but it cannot get the details of the blade surface pressure distribution, and cannot provide accurate aerodynamic load data for the structural analysis of wind turbine blades. On the contrary, CFD simulation is a cheap and efficient way to provide valuable quantitative insight into the aerodynamic and aeroacoustic behaviors of flow around wind turbine. It has helped the industry become more efficient and productive and has enabled new designs and levels of efficiency not possible before [11,12].

CFD modeling and experiment have both advantages and disadvantages. They can be complementary to each other and one can expect more effective understanding of the phenomenon. The CFD

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Large-eddy simulation and wind-tunnel measurement of aerodynamics and aeroacoustics of a horizontal-axis wind turbine

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关键词

作者关键词: Large-eddy simulation; Wind-tunnel measurement; Horizontal-axis wind turbine; Aerodynamics; Aeroacoustics

KeyWords Plus: WAKE; MODEL; VORTEX; DESIGN

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